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(REV 11-98)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

PD990039

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/786691

INTERNATIONAL APPLICATION NO.

INTERNATIONAL FILING DATE

PRIORITY DATE CLAIMED

PCT/EP99/06377

30AUGUST1999 (30.08.99)

07 SEPTEMBER 1998 (07.09.98)

TITLE OF INVENTION

METHOD FOR ADDRESSING A BITSTREAM RECORDING (As published)

APPLICANT(S) FOR DO/EO/US

Harald Schiller, Heinz-Werner Keesen and Marco Winter

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210). attached to Item 13
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98. with 5 References attached
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information: **CERTIFICATE OF MAILING UNDER 37 CFR 1.10**

EL682442454US

March 7, 2001

"Express Mail" mailing no.

Date of Deposit

I hereby certify that this application is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Anelia F. Urban
Typed or printed name of person
mailing application

Anelia F. Urban
Signature of person mailing
application

09/786691

21. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):

- ☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO\$1000.00
- ☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO\$860.00
- ☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO\$710.00
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)\$690.00
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4)\$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

860.00

Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)).

☐ 20☐ 30

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	6 - 20 =	0	x \$18.00
Independent claims	1 - 3 =	0	x \$80.00

Multiple Dependent Claims (check if applicable).

☐

TOTAL OF ABOVE CALCULATIONS =

860.00

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable).

☐

SUBTOTAL =

860.00

Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).

☐ 20☐ 30

+

TOTAL NATIONAL FEE =

860.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).

☐

TOTAL FEES ENCLOSED =

860.00

Amount to be:

refunded

\$

charged

\$

860.00

☐ A check in the amount of to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. 07-0832 in the amount of \$860.00 to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 07-0832 A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Mr. Joseph S. Tripoli
THOMSON multimedia Licensing Inc.
Patent Department
PO Box 5312
Princeton, New Jersey 08540

SIGNATURE

Harvey D. Fried

NAME

28,298

REGISTRATION NUMBER

7 March 2001

DATE

01 MAR -9 AM 7:53

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Harald Schiller, Heinz-Werner Keesen and Marco Winter
Filed : Herewith - PCT National Phase of PCT/EP99/06377
For : METHOD FOR ADDRESSING A BIT STREAM TO BE RECORDED
OR BEING RECORDED ON A STORAGE MEDIUM

PRELIMINARY AMENDMENT

Hon. Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Sir:

In the US national phase application of PCT/EP99/06377 please enter the following amendments.

IN THE TITLE:

Please amend the title of the application to read -- METHOD FOR ADDRESSING A BITSTREAM RECORDING --.

IN THE SPECIFICATION:

Please amend the specification as follows:

Page 1, line 4, after the title, insert the following:

--This application claims the benefit under 35 U.S.C.

§ 365 of International Application PCT/EP99/06377, filed August 30, 1999, which was published in accordance with PCT Article 21(2) on March 16, 2000 in English, and which claims the benefit of EPO Application No. 98250315.3, filed September 7, 1998, EPO Application No. 98250387.2, filed November 4, 1998, EPO Application No. 99250179.1, filed June 8, 1999 and EPO Application 99250214.6, filed July 1, 1999.--

Page 1, line 5 insert as heading:

--Field of the Invention--

Page 1, line 23-25 insert the following paragraph --

-- EP-A-O 729 153 discloses a table that is used for trick play mode, in which table a time code is assigned to each sector on an optical disc suited for variable transfer rate. --

Page 1, line 26 delete "Invention" and
 insert as heading: --SUMMARY OF THE INVENTION--

Page 5, line 16 delete "Drawings" and
 Insert as heading: --BRIEF DESCRIPTION OF THE
DRAWINGS--

Page 5, line 34 delete "Exemplary embodiments" and
 insert as heading: --DETAILED DESCRIPTION--

IN THE CLAIMS:

Claims in condition for publication are included on a separate sheet.

Please amend the claims as follows which are Annexes to the International Preliminary Examination Report:

1. Method for addressing a bitstream to be recorded or being recorded on a storage medium [(STRD)], wherein:
 - an address table [(MAPL)] is used that is based on pieces [(SOBU#i)] of said bitstream;
 - said pieces each include a constant amount of bits of said bitstream;
 - said pieces contain data packets including an application time stamp [(ATS)],

[characterised by] comprising the [features] steps of:

 - using for delta time duration values [(IPAT#i)] an index running from '1' to 'n' or 'n-1', respectively, to each address table entry - or to each address table entry except the one having index 'n' - one of said delta time duration values is assigned, wherein such delta time duration value is the difference between the arrival time of the first data packet of a piece and the arrival time of the data packet

- following immediately the last data packet of that piece;
- apart from said delta time duration values [(IAPAT#i)], said address table contains an initial time value [(IAPAT#0)] that is not assigned to any of said pieces [(SOBU#i)];
 - in order to get an address value for reaching a target address [(DAV)] on said storage medium, said initial time value [(IAPAT#0)] and all delta time duration values up to the nearest time duration value for the piece corresponding to said target address become accumulated, wherein the running index (i) for the delta time duration entry [(IAPAT#i)] related to said nearest time duration value becomes multiplied by said constant bit amount in order to compute said address value, wherein said initial time value is selected such that the bits of said delta time duration values correspond in their weight to a corresponding number of the most significant bits of said application time stamps [(ATS)].
2. Method according to claim 1, wherein said storage medium [(STRD)] is a Streamer device or a DVD recorder.
 3. Method according to claim 1 [or 2], wherein the size of a piece corresponds to the number of bits of an ECC block or a multiple thereof.
 4. Method according to [any of claims] claim 1 [to 3], wherein said initial time value [(IAPAT#0)] corresponds to some, in particular '12', of the most significant bits of the application time stamp [(ATS)] of the first data packet of the first piece [(SOBU#1)] which is described by said address table [(MAPL)].
 5. Method according to [any of claims] claim 1 [to 4], wherein said address table is a mapping list [(MAPL)].

6. Method according to [any of claims] claim 1 [to 5], wherein the data packet arrival times used for calculating said delta time duration values are application time stamps [(ATS)] of corresponding ones of said data packets rounded down by setting least significant bits of said application time stamps to zero.

REMARKS

The title has been amended to conform with the translated title of the published application (WO 00/14744).


The specification has been amended to include a reference to the priority applications, to include page 1 of the Annex of the International Preliminary Examination Report, and to meet the requirements of the USPTO.

The above amendments to the claims have been made to eliminate the multiple dependencies, reference indicia and to meet the requirements of the USPTO.

A replacement Abstract is supplied on a separate sheet.

No fee is believed to have been incurred by virtue of this amendment. However if a fee is incurred on the basis of this amendment, please charge such fee against deposit account 07-0832.

Respectfully submitted,
Harald Schiller
Heinz-Werner Keesen
Marco Winter



Harvey D. Fried
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March 7, 2001

Claims

1. Method for addressing a bitstream to be recorded or being recorded on a storage medium, wherein:

- 5 - an address table is used that is based on pieces of said bitstream;
- said pieces each include a constant amount of bits of said bitstream;
- said pieces contain data packets including an application time stamp, comprising the steps of:
- 10 - using for delta time duration values an index running from '1' to 'n' or 'n-1', respectively, to each address table entry - or to each address table entry except the one having index 'n' - one of said delta time duration values is assigned, wherein such delta time duration value is the difference between the arrival time of the first data packet of a piece and the arrival time of the data packet following immediately the last data packet of that piece;
- 15 - apart from said delta time duration values, said address table contains an initial time value that is not assigned to any of said pieces;
- in order to get an address value for reaching a target address on said storage medium, said initial time value and all delta time duration values up to the nearest time duration value for the piece corresponding to said target address become accumulated, wherein the running index (i) for the delta time
- 20 duration entry related to said nearest time duration value becomes multiplied by said constant bit amount in order to compute said address value, wherein said initial time value is selected such that the bits of said delta time duration values correspond in their weight to a
- 25 corresponding number of the most significant bits of said application time stamps.

2. Method according to claim 1, wherein said storage medium is a Streamer device or a DVD recorder.

3. Method according to claim 1, wherein the size of a piece corresponds to the number of bits of an ECC block or a multiple thereof.

4. Method according to claim 1, wherein said initial time value corresponds to some, in particular '12', of the most significant bits of the application time stamp of the first data packet of the first piece which is described by said address table.

5. Method according to claim 1, wherein said address table is a mapping list.

6. Method according to claim 1, wherein the data packet arrival times used for calculating said delta time duration values are application time stamps of corresponding ones of said data packets rounded down by setting least significant bits of said application time stamps to zero.

Abstract

In bitstream recording presentation data is organised into Video Object Units.

These have a variable size but have also a variable duration. To allow access to

5 any Video Object Unit in the bitstream a mapping list is used which is based on pieces of the bitstream of constant size per piece. The mapping list additionally contains for each of these pieces a specific delta duration which indicates the difference between the arrival time of the first packet of a piece and the arrival time of the packet following immediately the last packet of that piece, and

10 contains an initialisation value which allows to have a share of equal bits between a predetermined amount of MSBs of application time stamps and the same amount of LSBs of the summation of said delta time durations. The computation of the target SOBU address includes the following steps:

- accumulate the initialisation value and the delta durations until the given time
- 15 value is most closely reached towards the target SOBU;
- the running index of this table entry multiplied by the constant piece size directly results in the address value to be accessed.

PTSP/PT Reg'd 07 MAR 2001

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The invention relates to a method and to an apparatus for
addressing a bitstream to be recorded or being recorded on a
5 storage medium, e.g. an optical disc.

Background

In bitstream recording one is free to subdivide the bit-
10 stream into sub-units of more regular structure. Presenta-
tion data in DVDs (digital video or versatile disc) is or-
ganised into units called Video Object Unit, denoted VOBU,
or Stream Object Unit, denoted SOBU, e.g. in the DVD VR
Specification for DVD Video Recording in which the units are
15 called VOBUS. VOBUS have a variable size (data amount meas-
ured in number of sectors), but have also a variable dura-
tion (measured in number of video fields). SOBUs have a con-
stant size, but have also a variable duration.

For data retrieval from the disc the DVD VR specification
20 foresees a 'VOBU map' which is a table where for every VOBU
in a recording the length in sectors and the duration in
fields is entered.

EP-A-0 729 153 discloses a table that is used for trick play
mode, in which table a time code is assigned to each sector
25 on an optical disc suited for variable transfer rate.

Invention

A table for data retrieval from a storage medium can be
30 based on bitstream data being subdivided into pieces of con-
stant duration. 'Duration' means the difference between the
arrival time of the first packet of a piece and the arrival
time of the packet following immediately the last packet of
that piece.

35 'Housekeeping' in the general context of either DVD VR re-
cording or Stream recording is the task to translate a given

time value (presentation time in case of DVD VR recording or packet arrival time in case of Stream recording) into a disc address value where the desired data can be found.

In such systems the VOB or SOBU map or 'mapping list', denoted MAPL, can contain a specific size or a specific offset or a specific delta size or, in general, a specific address-like quantity for each of these constant-duration pieces. By storing delta values instead of the total duration at a current VOB or SOBU these entries can be described with

shorter word length which helps to keep the total MAPL in a reasonable size.

A possible type of housekeeping process for these systems could include the following steps:

- By division and truncation, calculate from the given time value the index of the mapping list entry to be looked up.
- The content of the mapping list entry either directly specifies the address value to access, or all mapping list entries up to that index have to be accumulated to get the address value to be accessed.

The big disadvantage of such type of MAPL which is based on constant-duration pieces lies in the following:

- In case of a low bitrate recording the pieces of constant duration will be small in size, i.e. every piece will comprise a few data sectors only or, in the extreme, a fraction of a data sector only. The disc can contain enormous numbers of those pieces, so that the MAPL may become too big to be kept in the memory.
- In case of high bitrate recording, the pieces of constant duration are big in size, i.e. each piece will comprise many data sectors. Then, addressing one piece or another corresponds to a very coarse addressing on the (sector) scale, i.e. a piece address derived from the MAPL can be located many sectors away from the currently desired location.

Therefore housekeeping based on constant-duration pieces can result in a too big MAPL in some cases (up to one half of the disc capacity), and can result in too coarse addressing in other cases.

5 It is one object of the invention to disclose a method for assigning to a given time value a storage medium address value which method avoids such disadvantages. This object is achieved by the method disclosed in claim 1.

10 According to the invention the mapping list MAPL is based on pieces of constant length or size, i.e. a constant number of bits per piece.

In a medium like DVD-RAM where data are physically organised into 'ECC blocks' (ECC: error correction code) of 32kByte
15 length each, particular advantages result if the above constant size or a multiple of it is used as the constant size of a piece. However, any other constant size can be used. In this case of pieces of constant size the MAPL contains for each of these pieces of constant size a specific absolute
20 duration or, preferably, a specific delta duration which indicates the arrival time of the first packet of a piece and the arrival time of the packet following immediately the last packet of that piece.

The housekeeping process, i.e. the computation of the target
25 VOB or SOB address includes the following steps:

- Accumulate the delta durations contained in the MAPL until the given time value is most closely reached towards the target VOB or SOB, i.e. until the sum of delta durations is less than or equal to the given time value and
30 the result after addition of the next delta duration is greater than the given time value assuming that forward scanning of the VOB or SOB entries is performed, or until the sum of delta durations is greater than the given time value assuming that backward scanning of the VOB or
35 SOB entries is performed.
- The running index of this mapping list entry multiplied

by the constant piece size directly results in the address value to be accessed.

The advantages of the inventive constant-size based MAPL are:

- the MAPL size does not depend on the bitrate of the recordings,
- the MAPL addressing accuracy is constant, the granularity basically corresponds to the 'piece size constant' which can be chosen as appropriate to be constant for all types of discs, to be constant per disc, or to be constant per recording on a specific disc.

Advantageously, the address table contains an additional initialising value to initialise the accumulation of the delta time durations.

In principle, the inventive method is suited for addressing a bitstream to be recorded or being recorded on a storage medium, e.g. a DVD recorder, wherein an address table is used that is based on pieces of said bitstream, and wherein:

- said pieces each include a constant amount of bits of said bitstream;
- using a running index, to each address table entry for said pieces, in particular to each address table entry except the one having the highest index, a delta time duration is assigned in said address table;
- the address table contains in addition an initialisation value which allows to have a share of equal bits between a predetermined amount of MSBs of application time stamps and the same amount of LSBs of said delta time durations;
- in order to get an address value for reaching a target address said initialisation value and all delta time durations up to the nearest time duration corresponding to said address value become accumulated and the running index corresponding to the delta time duration entry related to said nearest time duration becomes multiplied by

said constant amount in order to compute said address value.

Advantageous additional embodiments of the inventive method
5 are disclosed in the respective dependent claims.

Drawings

10 Embodiments of the invention are described with reference to the accompanying drawings, which show in:
Fig. 1 simplified overall system for DVD Stream Recording;
Fig. 2 basic directory and file structure;
Fig. 3 navigation data structure;
15 Fig. 4 a stream pack;
Fig. 5 inventive mapping list;
Fig. 6 structure of this mapping list;
Fig. 7 mapping list example;
Fig. 8 comparison of several time values;
20 Fig. 9 IAPAT structure;
Fig. 10 APAT and PAT structure;
Fig. 11 ATS structure.

25 Exemplary embodiments

The DVD VR stream recording system is designed to use rewritable DVD discs for recording existing digital bitstreams, editing them and playing them back as bitstreams.

30 The following abbreviations are used:

AP: Application Packet, APAT: Application Packet Arrival Time, ATS: Application Timestamp, IAPAT: Incremental APAT (delta values with 12 bit resolution), LB: Logical Block,
35 LSBs: least significant bits, MAPL: Mapping List, MSBs: most significant bits, MTU_SHFT: Mapping Time Unit Shift (an un-

signed integer value, e.g. 18), PAT: Packet Arrival Time, RBN: relative byte number, RBP: relative byte position, RLBN: relative logical block number, SCR: system clock reference, SOB: Stream Object, SOBU: Stream Object Unit,

5 SOB_E_APAT: APAT of the last AP of the SOB, SOB_S_APAT: APAT of the first AP of the SOB, SOBU_S_APAT: APAT of the first AP of the SOBU, STB: set top box, SUM_IAPAT = Summation of IAPAT values, TOC: table of content.

10 This system is designed to satisfy the following requirements:

A timing mechanism, i.e. a time stamp is added to every broadcast packet to enable proper packet delivery during playback.

15 To enlarge the fields of applications, non-real-time recording should be possible. However, in this case the STB has to generate the Time Stamp information.

Data allocation strategy and file support real-time stream recording.

20 Many digital services require Service Information which normally is embedded in the real-time stream. To support a STB fed by data from a DVD player, the DVD should provide additional space, which can be used by the STB to duplicate part of the service information and to add additional TOC information..

25 Copy Protection must be supported. In addition, any scrambling performed by the service provider or the STB must be kept unchanged.

User requirements can be grouped into requirements for recording, requirements for playback, and requirements for editing:

Real-time Recording

The system should be designed to enable real-time recording of digital streams. It also should allow the user to concatenate recordings, even if those recordings consist of

35 different stream formats. If recordings are concatenated, a

seamless or close to seamless playback possibility would be nice but is not required.

Navigation Support

5 To support navigation two pieces of information (lists) should be generated during recording:

1) An 'original' version of a play list. This list contains quite low level information, e.g. time map or (broadcast) packet order of the recording. This list is accessible by

10 the STB and the content is understood by the DVD streamer as well as by the STB. In its original version the playlist enables the playback of a complete recording. The playlist may be accessed and extended after recording by the STB to allow more sophisticated playback sequences.

15 2) The second piece of information, a mapping list, is generated to support the stream recorder to retrieve packet stream chunks (cells), that are described in terms of the application domain, e.g. 'broadcast packets' or 'time'. This list is owned and understood by the DVD streamer only.

20

Content Description

The system should reserve space which can be used by the STB to store high level TOC and Service Information. This information is provided for the user to navigate through the content stored on disc and may contain sophisticated GUI information. The content needs not to be understood by the stream recorder. However a common subset of the TOC information, e.g. based on a character string, may be useful to be shared between STB and DVD, in order to enable the stream recorder to provide a basic menu by itself.

30

Playback of individual recording and playing all recordings sequentially should be possible via play list.

35 *Player menus for entry point selection*

The STB can generate a sophisticated menu based on the TOC

information stored on the disc. However, it should be possible to generate a simple menu by the streamer itself, e.g. via some 'character' information which is shared by STB and DVD.

5

Trick play modes

The STB should be able to steer trick play via the 'play list'. Due to the nature of the broadcast stream, the trick play features may be limited to basic ones, e.g. Time Search and Title Jump.

10

User defined playback sequence features like programming or parental control can be supported via the play list

The DVD streamer should create the 'original version' of the play list. It also should allow extensions and modifications of the play list by the STB for more sophisticated playback features. The DVD streamer is not responsible for the content of those sophisticated playlist(s).

15

The system must support the deletion of single recordings on user's request. If possible, the system should allow this feature under the control of the STB.

20

The system may support insert editing.

In the simplified overall system of Fig. 1 an application device AD interacts via an interface IF, e.g. an IEEE1394 interface, with a streamer device STRD, i.e. a DVD recorder. A streamer STR within STRD sends its data via output buffering & timestamping handling means BTHO to IF and receives from IF data via input buffering & timestamping handling means BTHI. AD sends its data via output buffering & timestamping handling means BTHO to IF and receives from IF data via input buffering & timestamping handling means BTHIAD.

30

Concerning the directory and file structure, the organisation of Stream Data and Navigation Data of DVD Stream Re-

35

cording is done in a specific way such as to take into account the following:

- Any DVD Streamer device STRD has certain requirements to store its own mapping list or Streamer-specific navigation data on the disc. These data are solely for helping the retrieval of recorded data; they need not be understood or even be visible to any outside application device AD.
- Any DVD Streamer device STRD needs to communicate with the application device AD it is connected to. This communication should be as universal as possible so that the maximum possible range of applications can be connected to the Streamer. The Navigation Data to support such communication are called Common navigation data and must be understandable by the Streamer as well as by the application device.
- The Streamer device STRD should offer to the connected application device AD a means for storing its own private data of any desired kind. The Streamer needs not to understand any of the content, internal structure, or meaning of this Application-specific navigation data.

Fig. 2 illustrates a possible directory and file structure where all the data comprising the disc content are. The files storing the disc content are placed under the STRREC directory which is under the root directory. Under the STRREC directory the following files are created:

- COMMON.IFO
Basic information to describe the stream content. Needs to be understood by the Application Device as well as the Streamer.
- STREAMER.IFO
Private stream object information specific to the Streamer Device. Needs not to be understood by the Application Device.
- APPLICAT.IFO

Application Private Data, i.e. information that is specific to the Application(s) connected to the Streamer.

Needs not to be understood by the Streamer.

- REALTIME.SOB

5 Recorded real-time stream data proper.

Note that except for the files described above, the STRREC directory shall not contain any other files or directories.

Concerning the navigation data structure, Navigation data is provided to control the recording, playing back, and editing of any bitstreams that are recorded. As shown in Fig. 3, Navigation Data includes Streamer Video Manager Information (STR_VMGI) as contained in the file named COMMON.IFO and Stream File Information (SFI) as contained in the file named STREAMER.IFO. From the point of view of the Streamer Device, these two kinds of information are sufficient to perform all necessary operations.

In addition to these, DVD Stream Recording also foresees the possibility of reserving a storage location for Application Private Data APD_MG, which may in general also be considered as Navigation Data.

STR_VMGI and SFI are the Navigation Data which are directly relevant for the Streamer operation. STR_VMGI includes two kinds of information tables, namely Video Manager Information Management Table (VMGI_MAT) and Play List Search Pointer Table (PL_SRPT), in this order. SFI includes three kinds of information tables, namely Stream File General Information (SF_GI), SOBI Search Pointers #n (SOBI_SRP#n) and all Stream Object Information #n (SOBI#n), in this order.

30 There is no restriction in Stream Recording that each table within Navigation Information must be aligned with a sector boundary.

VMGI_MAT includes information items like end address of Streamer Information (STRI), end address of STR_VMGI, start address of Stream File Information Table (SFIT), start address of Original Program Chain Information (ORG_PGCI) and

start address of User Defined Program Chain Information Table (UD_PGCIT).

PL_SRPT includes information items like Number of Playlist Search Pointers, end address of PL_SRPT, Program Chain numbers of Playlist Information, Playlist Create Time and Primary Text Information.

Stream Object Information General Information (SOBI_GI) includes information items like SOB Type (SOB_TY), SOB Recording Time (SOB_REC_TM), SOB Stream Information Number (SOB_STI_N), Access Unit Data Flags (AUD_FLAGS), SOB Start APAT (SOB_S_APAT), SOB End APAT (SOB_E_APAT), first SOBU of this SOB (SOB_S_SOBU), number of Mapping List entries (MAPL_ENT_Ns).

MAPL_ENT_Ns describes the number of mapping list entries to follow after SOBI_GI.

The purpose of the inventive Mapping List MAPL is to provide all necessary information so that given playlist entries are efficiently translated into disc address pairs, and viceversa.

It is also possible to include Application Private Data which consist of three kinds of information, namely Application Private Data General Information, a set of one or more Application Private Data Search Pointers, and a set of one or more Application Private Data Area. If any Application Private Data exists, these three kinds of information become recorded and stored in this order in the APPLICAT.IFO file.

Stream Data include one or more Stream Objects (SOBs) each of which can be stored as a 'Program stream' as described in ISO/IEC 13818-1, Systems.

A SOB can be terminated by a program_end_code. The value of the SCR field in the first pack of each SOB may be non-zero. A SOB contains the Stream Data packed into a sequence of

'Stream Packs' (S_PCKs). Stream data can be organised as one elementary stream and are carried in PES packets with a stream_id.

- 5 As shown in Fig. 4 a Stream Pack includes a 14-byte pack header and a Stream PES Packet to which a 6-byte PES packet header, a Substream ID byte and a Stream Data Area belongs. The Stream Data Area is headed by a 9-byte Application Header and optionally by an Application Header Extension,
10 whereby the remaining part is the Application Packet Area. A Stream Object is composed of one or more Stream Packs.

The MAPL table depicted in Fig. 5 contains n pieces or SOBU's SOBU#1 to SOBU#n of the bitstream to be recorded or of the
15 recorded bitstream. To SOBU#1 to SOBU#n-1 a corresponding Incremental Application Packet Arrival Time entry IAPAT#1 to IAPAT#n-1 is assigned. DAV denotes a desired address or target address in the bitstream. SOBU#1 to SOBU#n each concern a constant number of bits of the bitstream.

20 As shown in Fig. 6, the Mapping List includes the Initial Time of the MAPL IAPAT#0 and zero or more instances of "Incremental Application Packet Arrival Time" (IAPAT).

	Contents	Number of Bytes
(1) IAPAT	Incremental APAT	2
	Total	2

- 25 The structure of the IAPAT value is depicted in Fig. 9. IAPAT describes the Incremental Application Packet Arrival Time of the corresponding Stream Object Unit in DVD Stream Recording's Incremental PAT Describing Format defined below.
- 30 For an explanation on how to calculate IAPAT(i) during recording, the following notations will be used:

- For abbreviation, M shall denote the number of Mapping List entries MAPL_ENT_Ns.
 - SOBU_S_APAT(i) ($1 \leq i \leq M$) shall denote the start Application Packet Arrival Time of the Stream Object Unit #i of the Stream Object, i.e. the packet arrival time of the first packet belonging to the Stream Object Unit #i. SOBU_S_APAT(1) shall be equal to the Application Time Stamp of the first Application Packet of Stream Object Unit #1 of the Stream Object.
 - IAPAT(0) shall denote the initial value for the Mapping List.
 - IAPAT(i) shall denote the i-th entry of the Mapping List, i.e. IAPAT(0) is the first and IAPAT(M-1) is the last entry of the Mapping List.
 - SUM_IAPAT(i) shall denote the summation of the IAPATs from 0 to i ($i < M$)

$$\text{SUM_IAPAT}(i) = \text{IAPAT}(0) + \text{IAPAT}(1) + \dots + \text{IAPAT}(i) \quad (\text{eq 1})$$
with $\text{SUM_IAPAT}(-1) = 0$.
- Then IAPAT(i) shall be chosen such that
- $$\text{IAPAT}(i) = \text{floor}(\text{SOBU_S_APAT}(i+1)/2^{\text{MTU_SHIFT}}) - \text{SUM_IAPAT}(i-1) \quad (\text{eq 2})$$
- for $i = 0, 1, 2, \dots, M-1$.
- The IAPAT value range is limited by the resolution (12 bit) of an IAPAT value and its minimum value ($\text{IAPAT}(i) = 1$ for $i > 0$ and $\text{IAPAT}(0) = 0$):
- $$0 \leq \text{IAPAT}(0) < 2^{12} \quad (\text{eq 3})$$
- and
- $$1 \leq \text{IAPAT}(i) < 2^{12} \quad \text{for } i > 1 \quad (\text{eq 4})$$
- The floor function floor(x) rounds down, e.g. floor(1.2) = floor(1.8) = 1, floor(-1.2) = floor(-1.8) = -2.
- SOBU_S_APAT(i) is described in the DVD Stream Recording PAT Describing Format. But, in evaluating the equations above

they must be treated as if they were 6 byte unsigned integer values.

Fig. 7 shows, along the time axis, an example of the order of SOBU, SOBU_S_APAT and IAPAT. The left side of the time axis is divided into 'Mapping Time Units' and the right side of the time axis shows the SOBUs.

Mapping Time Unit is a duration corresponding to IAPAT = 1, and can be calculated as

$$\text{Mapping Time Unit} = (2^{(\text{MTU_SHIFT}-9)} / 90000) \text{ seconds} \quad (\text{eq 5})$$

For MTU_SHFT = 18 bit it corresponds to approx. 5.69 milli-seconds.

SOB_S_APAT describes the start Application Packet Arrival Time of a Stream Object, i.e. the packet arrival time of the first packet belonging to the SOB. SOB_S_APAT is described below in the DVD Stream Recording PAT Describing Format:

PATs consist of a base part and an extension part. The base part holds the so-called 90kHz unit value, and the extension part holds the less significant value measured in 27MHz units.

(a) Choosing SOB_S_APAT for a new recording

A newly recorded SOB will normally start with the first Application Packet of a SOBU. In this case, SOB_S_APAT and the Application Timestamp of the first Application Packet of the SOB will normally be set to 0.

(b) Calculation of SOB_S_APAT after editing

After editing, e.g. deleting the start of a SOB, SOB_S_APAT, the Application Timestamp of the first Application Packet of the first SOBU of the SOB and the Application Timestamp of the first Application Packet belonging to the SOB may differ and may be not equal to 0.

All possible cases are covered by the following general definition of SOB_S_APAT:

- let ats_e be the 30-bit Application Timestamp of the first Application Packet belonging to the SOB and
 - let N be the number of all Application Timestamp wrap-arounds occurring between the 30-bit Application Timestamp of the first Application Packet starting in the first SOBU of the SOB and ats_e , i.e. $0 \leq N \leq 1$, then
- $$SOB_S_APAT[MTU_SHFT + 11...0] = ats_e[MTU_SHFT + 11...0]$$
- $$SOB_S_APAT[47...MTU_SHFT + 12] = N$$

With this definition of SOB_S_APAT , the APAT of the first Application Packet starting in the first SOBU of the SOB is equal to or greater than 0 and less than $2^{MTU_SHIFT+12}$.

Fig. 10 shows the DVD Stream Recording PAT Describing Format. The variables in this figure are defined as follows:

PAT_base : PAT's base value measured by 90kHz unit
 PAT_exten : PAT's extension value measured by 27MHz unit
 $(0 \leq PAT_exten < 300)$

$PAT \text{ in seconds} = (PAT_base/90000Hz) + (PAT_exten/27000000Hz)$

For an unique representation of times, PAT_exten must be in the range of $0 \leq PAT_exten < 300$. Together, PAT_base and PAT_exten cover a range of more than 1696 hours.

SOB_E_APAT describes the end Application Packet Arrival Time of the Stream Object, i.e. the packet arrival time of the last packet belonging to the SOB, in the DVD Stream Recording PAT Describing Format. The general definition of SOB_E_APAT is as follows:

- let ats_e be the 30-bit Application Timestamp of the last Application Packet belonging to the SOB and
- let N be the number of all Application Timestamp wrap-arounds occurring between the 30-bit Application Timestamp of the first Application Packet starting in the first SOBU of the SOB and ats_e , i.e. $N \geq 0$, then

$\text{SOB_E_APAT}[\text{MTU_SHFT} + 11 \dots 0] = \text{ats}_e[\text{MTU_SHFT} + 11 \dots 0]$
 $\text{SOB_E_APAT}[47 \dots \text{MTU_SHFT} + 12] = N$

The Application Time Stamp (ATS) in front of each Application packet consists of a 30-bit value. An ATS includes a base part and an extension part. The base part holds the so-called 90kHz unit value, and the extension part holds the less significant value measured in 27MHz units.

Fig. 11 depicts the DVD Stream Recording Application Time Stamp Describing Format. The variables in this figure are defined as follows:

AU_START when set to '1', indicates that the associated Application Packet contains a random access entry point (start of a random access unit) into the stream
 AU_END when set to '1', indicates the associated Application Packet is the last packet of a random access unit
 ATS_base base value of ATS measured in 90kHz units
 ATS_exten extension value of ATS measured in 27MHz units
 $\text{ATS in seconds} = (\text{ATS_base}/90000\text{Hz}) + (\text{ATS_exten}/27000000\text{Hz})$

For a unique representation of times, ATS_exten must be in the range of $0 \leq \text{ATS_exten} < 300$. Together, ATS_base and ATS_exten cover a range of more than 23 seconds.

Fig. 8 depicts the value ranges of ATS, IAPAT and SUM_IAPAT with respect to the 48-bit range of APAT. ATS covers bits 0 to 29. IAPAT covers bits 18 to 29. SUM_IAPAT covers bits 18 to 47.

A significant advantage of the invention is that the mapping list generates timestamps SUM_IAPAT of which the 12 LSB bits No. 18 to 29 are identical to the 12 MSB bits No. 18 to 29 of the stream timestamps ATS. This feature allows to simplify the real-time recorder hardware.

Example function for scanning the Presentation Data until the desired Application Packet is found

The following function describes how to scan Presentation Data in order to retrieve an individual application packet associated with a Packet Arrival Time 'x'. Thereby the Mapping List and the access to it is described in more detail, e.g. internal intermediate values which are required in subsequent steps, see Fig. 5, 6 and 7. The main result of Mapping List access is the Sector offset SOFF, indicating where the scanning starts. The complete scanning will be carried out inside a given SOB.

Notes on nomenclature used:

- x48 is a 6-byte APAT value which is indicated below by '48'.
 - The value '30' attached to other variables indicates that they consist of 30 bits, e.g. Application Time Stamp ATS.
 - IAPAT(0), IAPAT(1), ... denote the entries of the Mapping List.
 - The form var[a...b] denotes the bit field between and including bits a and b of the variable var.
 - '[i ... k]' denotes bits i to k of a binary number, i = MSB, k = LSB .
 - '/*...*/' denotes explanatory comments.
- In order to simplify the example it is assumed that each sector contains an integer number of at least one application packet(s).

Function get_application_packet_location(x48)

- a) sum_iapat48 = IAPAT(0) * 2^{MTU_SHIFT}; k = 1
- b) ss48 = IAPAT(k) * 2^{MTU_SHIFT}
- c) if (sum_iapat48 + ss48)[47...18] ≥ x48[47...18], then
go to g)
- d) sum_iapat48 = sum_iapat48 + ss48
- e) k = k + 1

```

f) if k < MAPL_ENT_Ns, then go to b)
g) soff = (k-1)*SOBU_SZ                                /* sector
   offset of SOBU#(k) relative to the 1st SOBU of the SOB */
h) offset48[47...30] = sum_iapat48[47...30]
5 i) offset48[29...0] = 0
j) current_ats30 = 0;
k) ap_no = 1
   /* Number of AP within Sector, 1 ≤ ap_no ≤ AP_Ns */
l) previous_ats30 = current_ats30
10 m) current_ats30 = (ATS of the application packet #ap_no of
   sector #soff)
n) if previous_ats30 is greater than current_ats30, then
   offset48 = offset48 + 230 /*handle ATS wrap around */
o) if current_ats30 + offset48 = x48 then
15 go to s)                                           /* target found! */
p) if sector #soff contains at least one more application
   packet start, then
   ap_no = ap_no + 1
   go to m)
20 q) soff = soff + 1
r) go to k)
s) end of function

```

The desired application packet is now retrieved as packet
 25 #ap_no of sector #soff. A value of ap_no = 1 denotes the
 first Application Packet starting in the Sector. A value of
 soff = 0 denotes the first Sector of the first SOBU of the
 SOB.

30 The above function is a more general example. It can be sim-
 plified if MTU_SHFT < 19. This requirement is fulfilled be-
 cause MTU_SHFT is defined as 18.

a) sum_iapat30 = IAPAT(0); k = 1

```

b) sum_iapat30 = sum_iapat30 + IAPAT(k)
c) if sum_iapat30 ≥ x48[47...18], then go to f)
d) k = k + 1
e) if k < MAPL_ENT_Ns, then go to b)
5 f) soff = (k-1)*SOBU_SZ                      /* sector off-
   set of SOBU #(k) relative to the 1st SOBU of the SOB */
g) ap_no = 1
   /* number of AP within Sector, 1 ≤ ap_no ≤ AP_PKT_Ns */
h) if (ATS of the application packet #ap_no of sector #soff)
10 equal to x48[29...0], then
   go to l)                                /* target found! */
i) if sector #soff contains at least one more application
   packet start, then
   ap_no = ap_no + 1
15 go to h)
j) soff = soff + 1
k) go to g)
l) end of function

20 The desired application packet is now retrieved as packet
   #ap_no of sector #soff. A value of ap_no = 1 denotes the
   first Application Packet starting in the Sector. A value of
   soff = 0 denotes the first Sector of the first SOBU of the
   SOB.

25 The 30 bits of ATS have the same weight as the 30 LSBs of
   APAT.
   It is not required that the first sector of the first SOBU
   of a SOB belongs to this SOB. If the first part of a SOB was
   erased, then the remaining SOB may start in the middle of a
30 SOBU, i.e. the first sector of this SOBU is not part of the
   SOB.

```

In Stream recording, the application performs its own padding, so that the pack length adjustment methods of DVD-ROM

Video or DVD-VR need not to be used. In Stream recording it is safe to assume, that the Stream packets will always have the necessary length.

The data stream also contains application time stamps ATS,
5 e.g. within the data packets.

Claims

- 5 1. Method for addressing a bitstream to be recorded or being recorded on a storage medium (STRD), wherein:
- an address table (MAPL) is used that is based on pieces (SOBU#i) of said bitstream;
 - said pieces each include a constant amount of bits of
10 said bitstream;
 - said pieces contain data packets including an application time stamp (ATS),
characterised by the features:
 - using for delta time duration values (IAPAT#i) an index
15 running from '1' to 'n' or 'n-1', respectively, to each address table entry - or to each address table entry except the one having index 'n' - one of said delta time duration values is assigned, wherein such delta time duration value is the difference between the arrival time
20 of the first data packet of a piece and the arrival time of the data packet following immediately the last data packet of that piece;
 - apart from said delta time duration values (IAPAT#i), said address table contains an initial time value
25 (IAPAT#0) that is not assigned to any of said pieces (SOBU#i);
 - in order to get an address value for reaching a target address (DAV) on said storage medium, said initial time value (IAPAT#0) and all delta time duration values up to
30 the nearest time duration value for the piece corresponding to said target address become accumulated, wherein the running index (i) for the delta time duration entry (IAPAT#i) related to said nearest time duration value becomes multiplied by said constant bit amount in order to
35 compute said address value,
wherein said initial time value is selected such that the

bits of said delta time duration values correspond in
their weight to a corresponding number of the most sig-
5 nificant bits of said application time stamps (ATS).

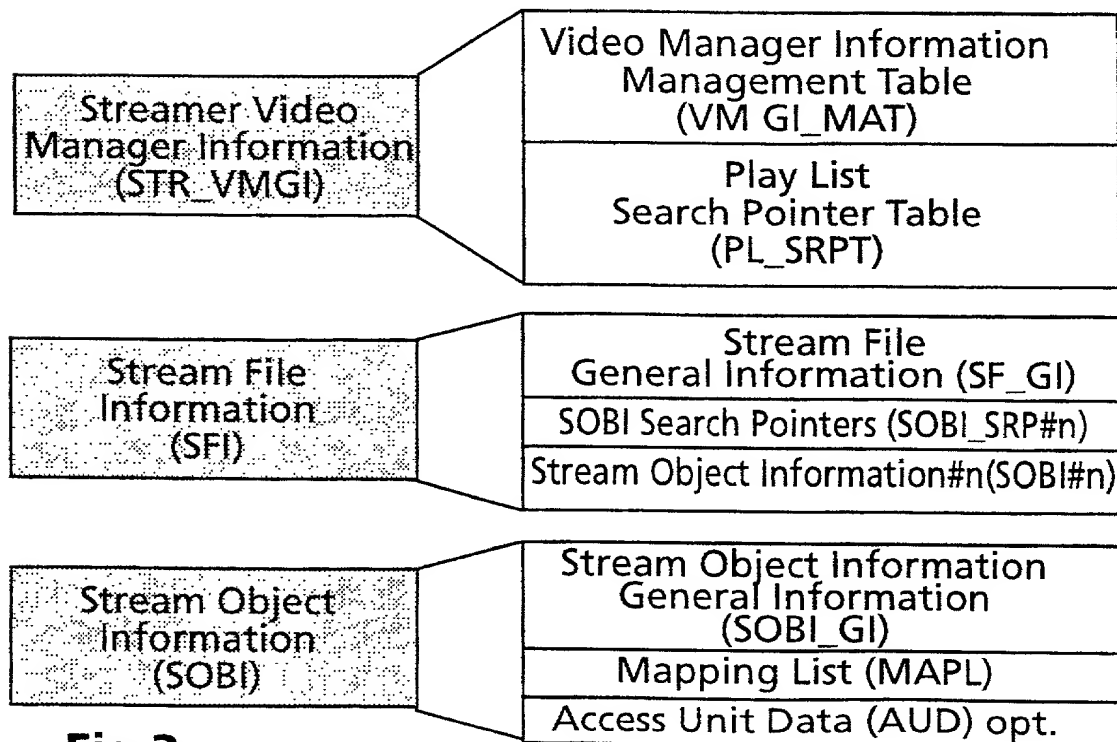
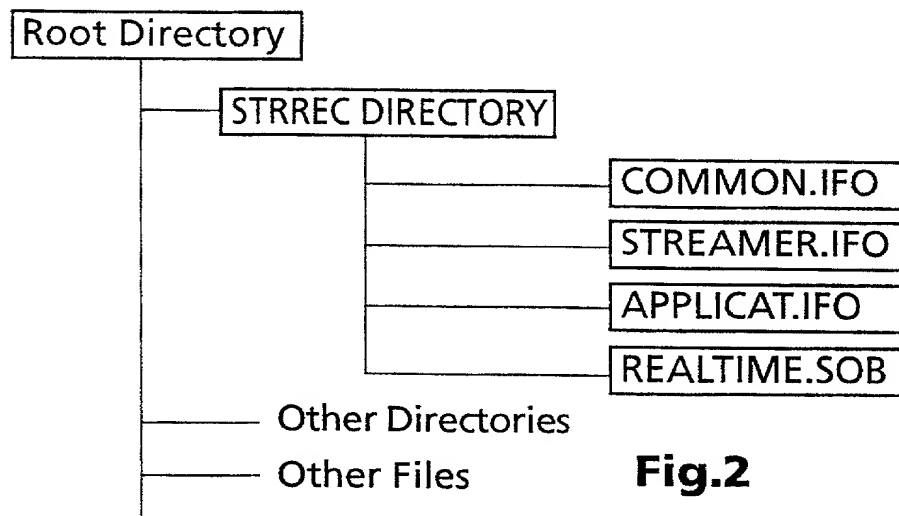
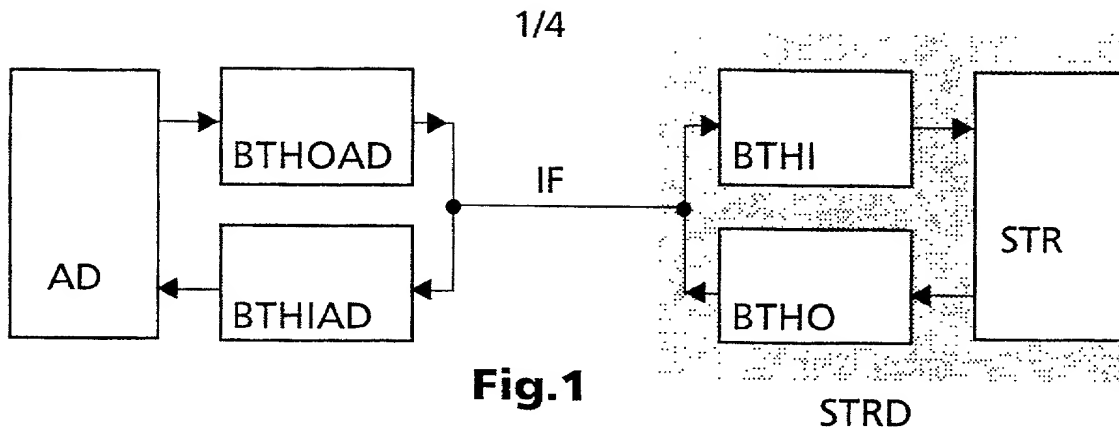
2. Method according to claim 1, wherein said storage medium
(STRD) is a Streamer device or a DVD recorder.

10 3. Method according to claim 1 or 2, wherein the size of a
piece corresponds to the number of bits of an ECC block
or a multiple thereof.

15 4. Method according to any of claims 1 to 3, wherein said
initial time value (IAPAT#0) corresponds to some, in par-
ticular '12', of the most significant bits of the appli-
cation time stamp (ATS) of the first data packet of the
first piece (SOBU#1) which is described by said address
table (MAPL).

20 5. Method according to any of claims 1 to 4, wherein said
address table is a mapping list (MAPL).

25 6. Method according to any of claims 1 to 5, wherein the
data packet arrival times used for calculating said delta
time duration values are application time stamps (ATS) of
corresponding ones of said data packets rounded down by
setting least significant bits of said application time
stamps to zero.



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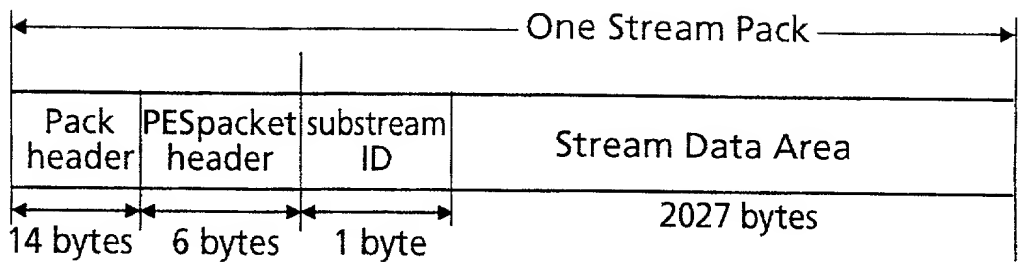


Fig.4

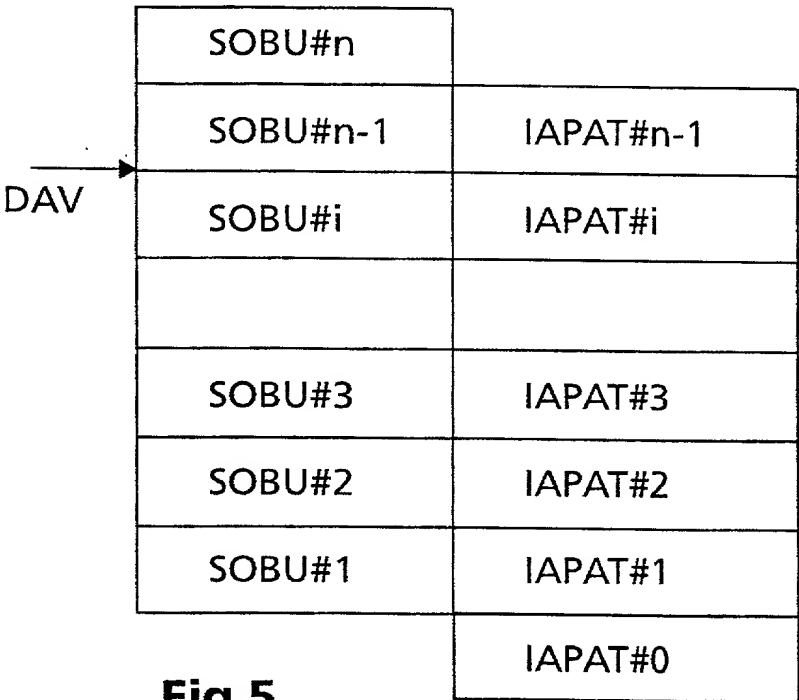


Fig.5

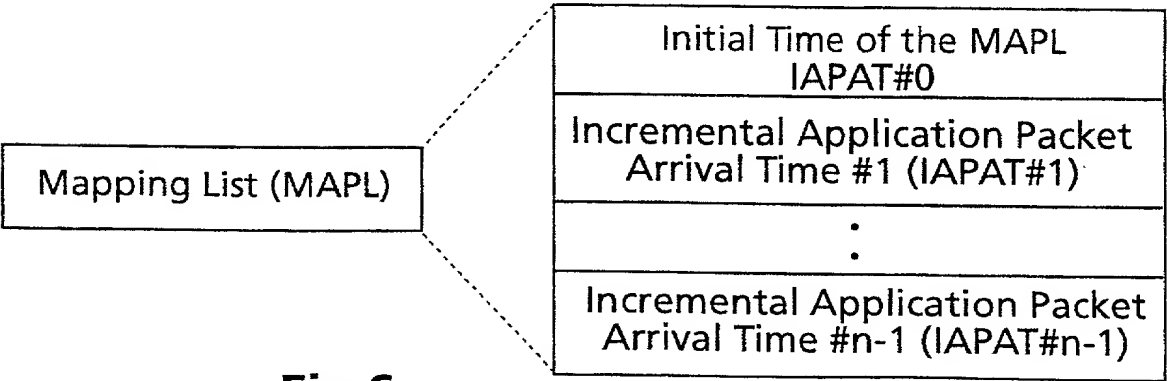
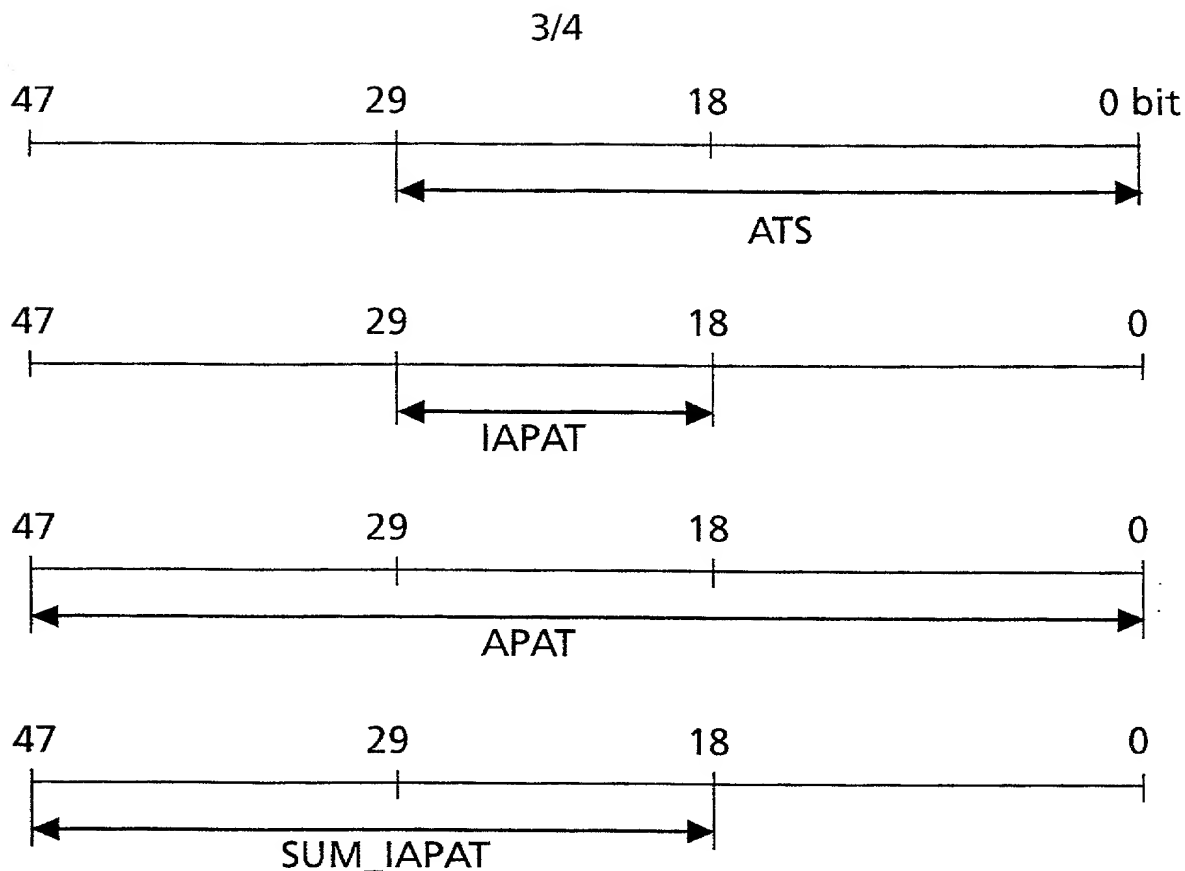
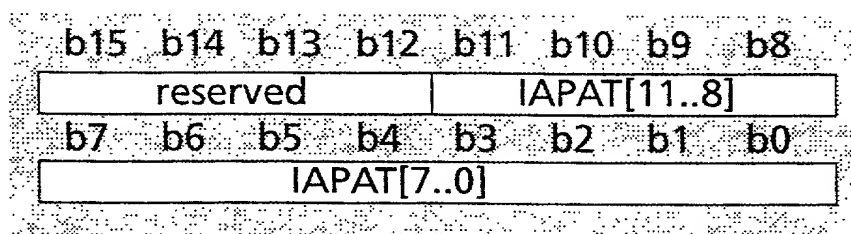
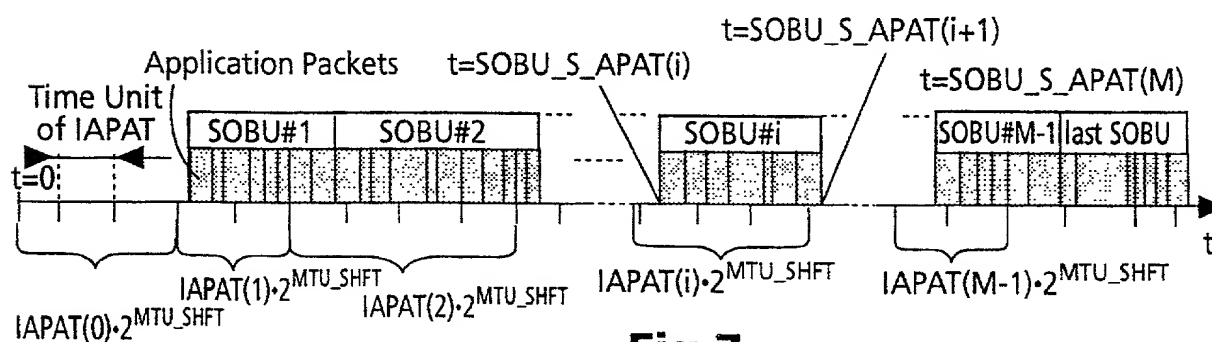
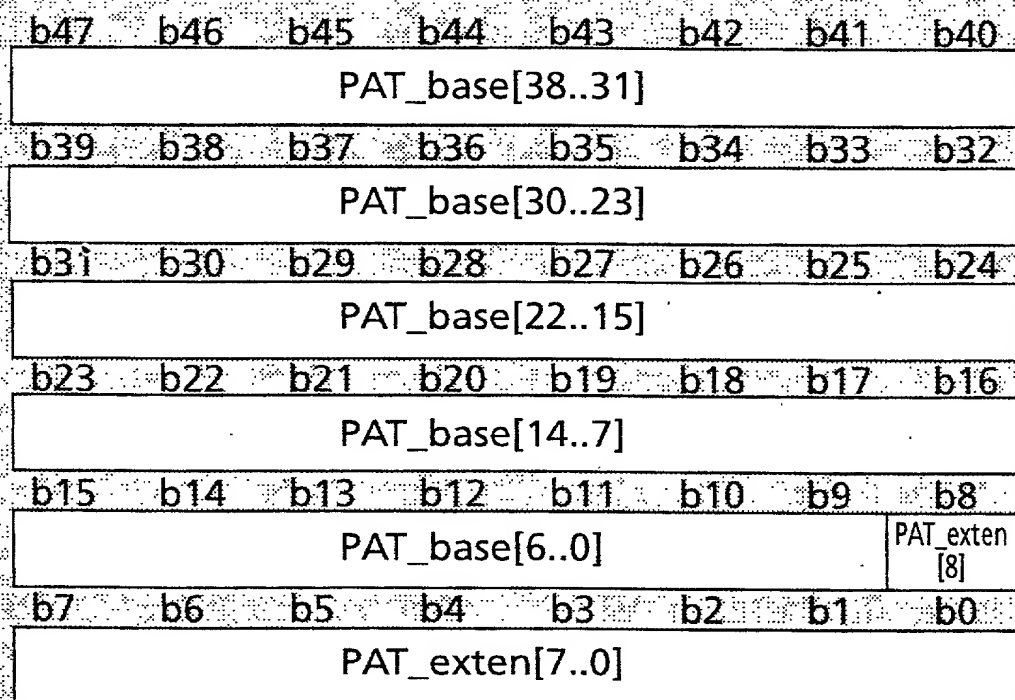
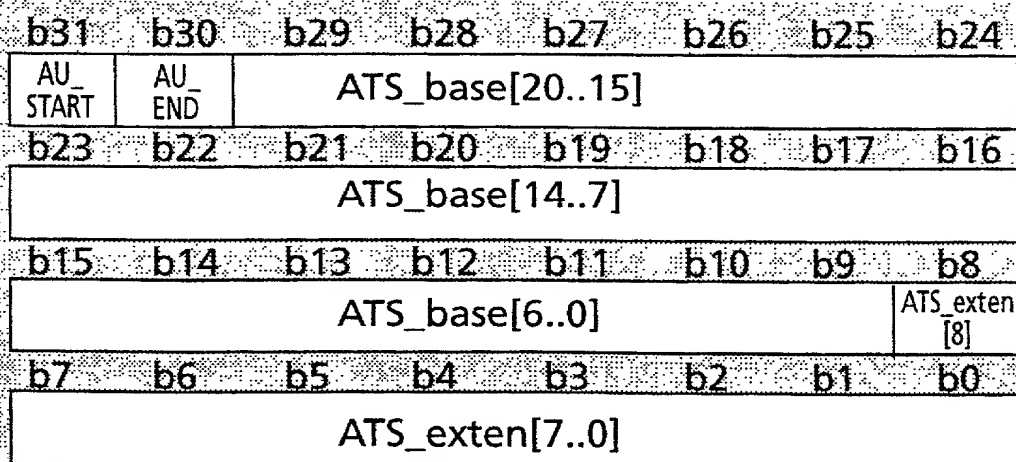


Fig.6

**Fig.8****Fig.9****Fig.7**

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**Fig.10****Fig.11**

DECLARATION FOR UNITED STATES PATENT APPLICATION,
POWER OF ATTORNEY, DESIGNATION OF CORRESPONDENCE ADDRESS

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and that I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD FOR ADDRESSING A BITSTREAM RECORDING

the specification of which

(CHECK ONE) (xx) is attached hereto.
() was filed on August 30, 1999, Application Serial. No. PCT/EP99/06377 and was amended on .

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR 1.56(a).

I hereby claim foreign priority benefits under 35 USC 119 of any foreign application(s) for patent, utility model, design or inventor's certificate having a filing date before that of the application(s) on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
Number	Country	Date Filed	Yes	No
98250315.3	EP	September 07, 1998	xx	
98250387.2	EP	November 04, 1998	xx	
99250179.1	EP	June 08, 1999	xx	
99250214.6	EP	July 01, 1999	xx	

I hereby claim the benefit under 35 USC 120 of any US Application(s) listed below, and, insofar as the subject matter of each of the claims of this Application is not disclosed in the prior US application in the manner provided by the first paragraph of 35 USC 112, I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR 1.56(a).

Serial No.: _____ Filed: _____

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under of 18 USC 1001 and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: Joseph S. Tripoli (Reg. No. 26,040) Telephone: (609) 734-9443.

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